

## **REMARKS**

Favorable reconsideration is respectfully requested in view of the foregoing amendments and the following remarks.

### **I. CLAIM STATUS AND AMENDMENTS**

Claims 3-5, 10-17, 20, 21 and 24-26 were pending in this application when last examined.

Claims 5, 10, 11, 20, 21 and 24 were examined on the merits and stand rejected.

Claims 3, 4, 12-17, 25 and 26 are indicated as allowed.

Claims 20 and 24 are amended to corrected clerical errors.

Claims 27-32 are newly added. Support can be found on page 13, lines 1-17 and page 14, lines 9-18 of the specification as filed.

No new matter has been added.

### **II. ART REJECTIONS**

On page 3 of the Office Action, claim 20 was rejected under 35 U.S.C 103(a) unpatentable over Pei et al. Applicants respectfully traverse this rejection.

#### **(1) Present invention**

The method of claim 20 is characterized by

- (1) introducing a nucleic acid into cells by electroporation, comprising
- (2) the step (A) of loading a nucleic acid onto the surface of an electrode;
- (3) the step (B) of allowing cells to adhere onto the surface of the obtained nucleic acid-loaded electrode; and
- (4) the step (C) of applying electric pulses to the adhering cells, wherein
- (5) the step (B) is carried out by incubating cells on the nucleic acid-loaded electrode.

According to the claimed method, a gene is efficiently introduced into cells without cell damage (page 45, lines 16-17 of the specification).

(2) Disclosure 1 of Pei et al.

(Abstract and page 464, right column, 1<sup>st</sup> and 2<sup>nd</sup> full paragraphs)

Pei et al. describes that the real-time surface plasmon resonance (BIAcore) technique was used to characterize and monitor the formation of a DNA/positively charged PDDA multilayer film (Abstract, lines 2-4).

Pei et al. also describes that the multilayer DNA/PDDA film-formed gold electrode was used for electrochemical impedance measurements (page 464, right column, 1<sup>st</sup> paragraph, lines 1-2 and 16-17).

In addition, Pei et al. describes that UV spectrum was measured while a multilayer DNA/PDDA film was formed on a quartz plate (page 464, right column, 2<sup>nd</sup> paragraph, lines 1-4 and 16-18).

These portions of Pei et al. neither describe nor suggest that a multilayer DNA/PDDA film-formed electrode was used in electroporation.

(3) Disclosure 2 of Pei et al.

(page 463, right column, 1<sup>st</sup> full paragraph)

Pei et al. merely describes “cationic polymers have been tested for possible application as genetic support materials in gene transfection.<sup>34,35</sup>” This portion of Pei neither describes nor suggests that the gene transfection using a cationic polymer is via electroporation (page 463, right column, 1<sup>st</sup> full paragraph, lines 2-6).

Further, references 34 and 35 on which the above description relies neither teach nor suggest electroporation. References 34 and 35 are enclosed herewith. [Attachment B and C]

Reference 34 teaches a gene transfection method wherein a cationic polymer/plasmid complex is incubated with cells to introduce the plasmid into the cells (page 62, columns “preparation of carrier/plasmid complex” and “Transfection protocol”). This method is not electroporation.

Reference 35 discloses adsorption of DNA onto polymer latex particles. This technique is also not related to gene transfection.

(4) Combination of disclosures 1 and 2 of Pei et al.

Thus, Pei et al. neither teaches nor suggests that a cationic polymer is used as genetic support material in electroporation.

Therefore, even if disclosure 2 of Pei et al. is combined with disclosure 1 of Pei et al., it would not have been obvious to the skilled artisan to have employed a multilayer DNA/PDDA film for electroporation.

Accordingly, Pei et al. only discloses that a nucleic acid was loaded on an electrode (limitation (2)), and the claimed method providing limitations (1)-(5) could not have been predicted to the skilled artisan.

Further, the method of the invention has technical effect unexpectedly superior to the method disclosed by Pei et al.

In particular, the gene transfection method of the invention is electroporation. On the other hand, Pei et al. merely discloses a gene transfection method using a cationic polymer as genetic support material (page 463, right column, 1<sup>st</sup> full paragraph, lines 2-6). Because the claimed method is completely different from the method of Pei et al., the effect of the claimed method cannot be compared with that of Pei's method under unified conditions.

The claimed method is different from Pei's method at least in that the claimed method provides a step of allowing cells to adhere onto the surface of an electrode and a step of applying electric pulses to the adhering cells (limitations (3) and (4)).

The §1.132 declaration attached hereto [Attachment A] clearly shows that the nucleic acid-introduction efficiency into living cells by the claimed method is superior to that of a method lacking limitations (3) and (4).

Therefore, the method of the invention has a technical effect unexpectedly superior to the method taught by Pei et al.

As a result, the invention of claim 20 is unobvious over Pei et al. and therefore Applicants respectfully suggest that this rejection is untenable and should be withdrawn.

On pages 3-4 of the Office Action, claims 5, 10, 11 and 21 were rejected under 35 U.S.C 103(a) as obvious over Pei et al. in view of Firth. Applicants respectfully traverse this rejection.

(1) Present invention

The method of claim 5 is characterized by

- (1) introducing a nucleic acid into cells by electroporation, comprising
- (2) the step (a) of providing an electrode with a cationic surface
- (3) the step (b) of absorbing and loading a nucleic acid onto the cationic surface of an electrode;
- (4) the step (c) of allowing cells to adhere onto the surface of the nucleic acid-loaded electrode obtained in the step (b); and
- (5) the step (d) of applying electric pulses to the cells, wherein
- (6) the electrode with a cationic surface is a transparent electrode on which a cationic polymer is adsorbed.

According to the claimed method, a gene is efficiently introduced into cells without cell damage (page 45, lines 16-17 of the specification).

(2) Rejection over Pei et al in view of Firth

(2-1) Pei et al

The office action states that Pei et al differs from the claimed invention in not teaching transparent electrodes (page 4, lines 4-5 of the office action). That is, the office action states that Pei et al differs from the claimed invention in not teaching limitation (6).

However, as mentioned above, Pei et al only teaches that the multilayer DNA/cationic polymer PDDA film was formed on an electrode (Abstract and page 464, right column, 1<sup>st</sup> and 2<sup>nd</sup> full paragraphs). Pei et al neither teaches nor suggests that a multilayer DNA/cationic polymer PDDA film-formed electrode was used in electroporation.

That is, Pei et al only discloses that an electrode with a cationic surface was provided and a nucleic acid was loaded on the cationic surface of the electrode (limitations (2) and (3)), and the claimed method providing limitations (1)-(6) could not have been predicted to the skilled artisan.

As a result, the inventions of claim 5 and its depending claims 10 and 11 are unobvious over Pei et al.

(2-2) Firth

Firth teaches electroporation (for example, title of the invention, lines 37-39 of column 5).

However, Firth neither teaches nor suggests that the electrode provides cationic surface.

In addition, in Firth, a nucleic acid is suspended in an electrolyte medium, not adhering onto an electrode (Fig.1, lines 39-41 of column 5 and lines 13-14 of column 6).

Therefore, Firth neither teaches nor suggests limitations (2), (3) and (4) of the invention.

As a result, the invention of claim 5 is not obvious over Firth.

### (2-3) Rejection over combination of Pei et al with Firth

The Examiner states that Pei et al differs from the claimed invention in not teaching transparent electrodes and that it would have been obvious to have modified the method of Pei et al by modifying the electroporation apparatus to use transparent indium-tin oxide coated glass slides of Firth (page 4, lines 4-10).

However, as mentioned above, Pei et al differs from the claimed invention in not teaching electroporation (limitations (1),(4),(5)) as well as not teaching transparent electrodes (limitation (6)).

Therefore, even if the electrode of Pei et al is replaced with the transparent electrode of Firth (column 5, lines 47-48), the claimed invention is not obtained.

Further, as explained above, Pei et al and Firth neither teach nor suggest limitation (4) of the invention. Therefore, the invention of claim 5 is unobvious over Pei et al in view of Firth.

Furthermore, as mentioned above, the claimed method has technical effect unexpectedly superior to the method taught by Pei.

As a result, the inventions of claim 5 and its depending claims 10 and 11 are unobvious over Pei et al in view of Firth. Thus, Applicants respectfully suggest that this rejection is untenable and should be withdrawn.

### Rejection of claim 21 over Pei et al in view of Firth

#### (1)Present invention

The method of claim 21 is characterized by

- (1) introducing a nucleic acid into cells by electroporation, comprising
- (2) the step (a) of providing an electrode with a cationic surface
- (3) the step (b) of adsorbing and loading a nucleic acid onto the cationic surface of an electrode;
- (4) the step (c) of allowing cells to adhere onto the surface of the nucleic acid-loaded electrode obtained in the step (b); and

- (5) the step (d) of applying electric pulses to the cells, wherein
- (6) the step (c) is carried out by incubating cells on the surface of the nucleic acid-loaded electrode.

According to the claimed method, a gene is efficiently introduced into cells without cell damage (page 45, lines 16-17 of the specification).

(2) Rejection over Pei et al in view of Firth

(2-1)Pei et al

As mentioned above, Pei et al only teaches limitations (2) and (3) of the invention and neither teaches nor suggests limitations (1), (4), (5) and (6). Therefore, the invention of claim 21 is unobvious over Pei et al.

Further, as mentioned above, the claimed method has technical effect unexpectedly superior to the method taught by Pei et al.

Therefore, the inventions of claim 21 and its dependent claims 27-29 are unobvious over Pei et al.

(2-2)Firth

As mentioned above, Firth neither teaches nor suggests limitations (2), (3) and (4) of the invention.

Therefore, the inventions of claim 21 and its dependent claims 27-29 are unobvious over Firth.

(2-3) Rejection over combination of Pei et al with Firth

As mentioned above, Pei et al and Firth neither teach nor suggest limitation (4) of the invention. Therefore, the invention of claim 21 is not obvious over Pei et al in view of Firth.

Further, as mentioned above, the claimed method has technical effect unexpectedly superior to the method taught by Pei et al.

Therefore, the inventions of claim 21 and its dependent claims 27-29 are unobvious over Pei et al in view of Firth. Thus, Applicants respectfully suggest this rejection is untenable and should be withdrawn.

Finally, on pages 4-5 of the Office Action, claim 24 was rejected under 35 U.S.C 103(a) as unpatentable over Pei et al. in view of Pohl. Applicants respectfully traverse this rejection.

(1) Present invention

The method of claim 24 is characterized by

- (1) introducing a nucleic acid into cells by electroporation, comprising
- (2) the step (a) of providing an electrode with a cationic surface
- (3) the step (b) of adsorbing and loading a nucleic acid onto the cationic surface of an electrode;
- (4) the step (c) of allowing cells to adhere onto the surface of the nucleic acid-loaded electrode obtained in the step (b); and
- (5) the step (d) of applying electric pulses to the cells, wherein
- (6) an electrode with the cationic surface is an electrode having a micropatterned surface.

According to the claimed method, a gene is efficiently introduced into cells without cell damage (page 45, lines 16-17 of the specification).

(2) Rejection over Pei et al in view of Pohl

(2-1) Pei et al

The office action states that Pei et al differs from the claimed invention in not teaching a micropatterned surface on the electrodes (page 5, lines 1-2 of the office action). That is, the office action states that Pei et al differs from the claimed invention in not teaching limitation (6).

However, as mentioned above, Pei et al only teaches limitations (2) and (3) of the invention and neither teaches nor suggests limitations (1), (4), (5) and (6) of the invention.

Further, as mentioned above, the claimed method has technical effect unexpectedly superior to the method taught by Pei.

Therefore, the inventions of claim 24 and its dependent claims 30-32 are unobvious over Pei et al.

(2-2) Pohl

Pohl teaches an apparatus for electrofusion of cells (For example, title of the invention and column 1, lines 51-52). This technique is not related to electroporation.

Therefore, even if Pohl teaches an electrode having a groove-formed surface (limitation (6)) (column 2, lines 58-60), the claimed method is not predictable from Pohl.

As a result, the inventions of claim 24 and its dependent claims 30-32 are unobvious over Pohl.

(2-3) Rejection over combination of Pei et al with Pohl

The office action states that it would have been obvious to one of ordinary skill in the art to have modified the method of Pei et al by adding grooves on the surface of the electrode as taught by Pohl (page 5, lines 5-6 of the office action).

However, as mentioned above, Pei et al only teaches limitations (2) and (3) of the invention and neither teaches nor suggests limitations (1), (4), (5) and (6) of the invention. Therefore, even if the electrode of Pei et al is replaced with the groove-formed electrode (limitation (6)) taught by Pohl, the claimed invention is not obtained.

Further, the office action states that the motivation to combine Pei et al with Pohl would have come from Pohl, which teaches that cells may be guided by the grooves (page 5, lines 6-8 of the office action).

However, in the claimed method, cells are adhered onto the surface of the electrode. Therefore, cells cannot be guided by the micropattern of the electrode surface.

In addition, in the claimed method, a micropattern is formed on the surface of the electrode in order to load multiple kinds of nucleic acids separately into each partition (lines 2-9 on page 26 of the specification).

Thus, purpose for using an electrode having a micropatterned surface is quite different between the claimed invention and Pohl.

Therefore, there is no motivation to form a micropattern on the surface of the electrode as Pohl teaches.

Furthermore, as mentioned above, the claimed method has technical effect unexpectedly superior to the method taught by Pei et al.

As a result, the inventions of claim 24 and its dependent claims 30-32 are unobvious over Pei et al in view of Pohl. Thus, Applicants respectfully suggest that this rejection is untenable and should be withdrawn.



**CONCLUSION**

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance and early notice to that effect is hereby requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact the undersigned attorney at the telephone number below.

Respectfully submitted,

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By 2010.07.06 15:11:52 -04'00'

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July 6, 2010